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ABSTRACT

This packet contains four papers that are designed to help broaden teachers' perspectives on the range of potential content and programs for technology education, as well as science, technology, and society (STS). The material provides basic instruction and information that would be useful in conducting interdisciplinary studies involving technology education classes along with areas such as economics, social studies, history, mathematics, and science. The four papers cover the following topics: (1) technological alternatives to problems facing society; (2) technology in our community; (3) technology in our homes; and (4) the technological evolution of a city. Each booklet outlines unique features of the concept, grade level to which it is suited, goals, instructional strategies, other methodologies, student productivity, student development, interdisciplinary potential, and resources. The packet also contains four black and white posters corresponding to the concepts. (KC)

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A Study of Technological Alternatives To Problems Facing Society

A Part of the
SCIENCE/TECHNOLOGY/SOCIETY
RESOURCE PACKAGE

Donald Maley

Professor Emeritus, University of Maryland
and Senior Fellow, ITEA

International Technology Education Association
Reston, VA

Preface

This publication is one of a number of efforts by the International Technology Education Association to help broaden individual teacher's perspective on the range of potential content and programs for Technology Education, as well as Science, Technology and Society (STS). This material provides basic instruction and information that would be useful in the conduct of inter-disciplinary studies involving Technology Education classes along with such areas as economics, social studies, history, mathematics and science. These materials may also be used by the Technology Education teachers in their development and conduct of programs that are new and innovative.

It is important to note that the conduct of such programs centers around a number of popular issues in contemporary education. Emphasis is placed on experiential and first-hand learning in practically all areas of the programs. Problem solving and inquiry are essential along with the integration of mathematics, science, social studies and environmental studies.

Another important element of such programs is that the laboratories as found in most schools at the middle, junior and senior higher levels can be used for the construction/experiential aspects without any significant change. This is not to say that modern technology and computers would not be useful. The issue is that one should not put a major laboratory rennovation as an obstacle to the carrying out of what can be a true and exciting study of technology.

Acknowledgements

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- *Paul Schiffman, Greece Athena Junior High School, Greece, NY*
- *Carl S. Schramm*
- *Kenneth L. Smith, Charles County Public Schools, La Plata, MD*

Figure 1 was developed by Daniel Mosser, a student in the Department of Industrial, Technological and Occupational Education at the University of Maryland, College Park.

Introduction

The goal of the Technological Alternatives to Problems Facing Society program is technological literacy for all persons living in a democratic society. The particular focus of this program is the needs of society in a world that is expected to double its population every 37 years.

This exponential growth, particularly in Third World countries, will call for increasing amounts of potable water, energy, food, transportation, housing, communications, clothing, means of trash and waste disposal, and production capacity. Technology will be called upon not only to provide the additional sources of such fundamental requirements for human existence, but also to advance. The areas of energy, food production and water development are particularly dependent on technology to tap new sources and to provide for adequate supply of such vital resources.

Another critical matter to be dealt with by technology is the anticipated growth of large cities. Again much of this will occur in Third World countries. The central problem here is trash and waste disposal. Here again, the solution must be decided upon after a careful analysis and understanding of the alternatives offered by technology and an informed assessment of the merits (and deficiencies) of each.

Decision-making in any of these problem areas is predicated on understanding the alternatives and being able to make the necessary assessment of the appropriateness of each. This is the basis for such a program as being one of the components of a well-balanced STS experience for all students.

Don Maley

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A Study of Technological Alternatives to Problems Facing Society

The principle focus of this strategy for teaching is technological literacy for the citizen of tomorrow. It examines the alternatives to such societal problems as: pollution, energy, water development transportation, housing, communications, trash and waste disposal, and production.

Unique Features

The program focuses on the decision-making processes. In a technological age, citizens are expected to be technologically literate about the issues and concerns affecting the local community, state and nation. Some unique features include:

- The content is relevant to the needs of the individual as a decision maker about critical issues in the present and future.
- The particular problems to be dealt with are common to most areas of the nation and the industrialized world.
- The problems identified have multiple alternative solutions for exploration, analysis, comparison and presentation.
- The major instructional strategy (the unit approach to instructional organization) has been tested and proven successful.
- The unit form of organization permits each student the opportunity to select a particular technological alternative in the problem area that is of interest to them.
- The study has excellent potential for hands-on laboratory experiences in addition to the written and oral reports.
- The problem areas for study are frequently local in nature or part of a major local or national concern.
- There is an abundance of information available in a variety of sources at the local, national and international levels.
- It is suitable for interdisciplinary study.

Grade Level

The study of technological alternatives is suited to secondary level students. The problem areas of energy, transportation, pollution, etc. are issues that confront the high school student in his or her daily life.

It also is important to note that since federal legislation gave 18-year-olds the right to vote, many secondary students can vote or will soon be eligible to. Problem areas are frequently linked with voting referenda or the political positions of persons seeking office. They constitute pertinent, relevant issues that depend on a great deal of technological literacy for one to take an informed position.

This is not to say that a teacher might decide to cover technological alteratives with a class at a lower grade. It could be conducted with success as low as the 9th grade and the processes and strategies would be very similar to those outlined in this presentation but modified for the more limited experience and knowledge of the middle level student.

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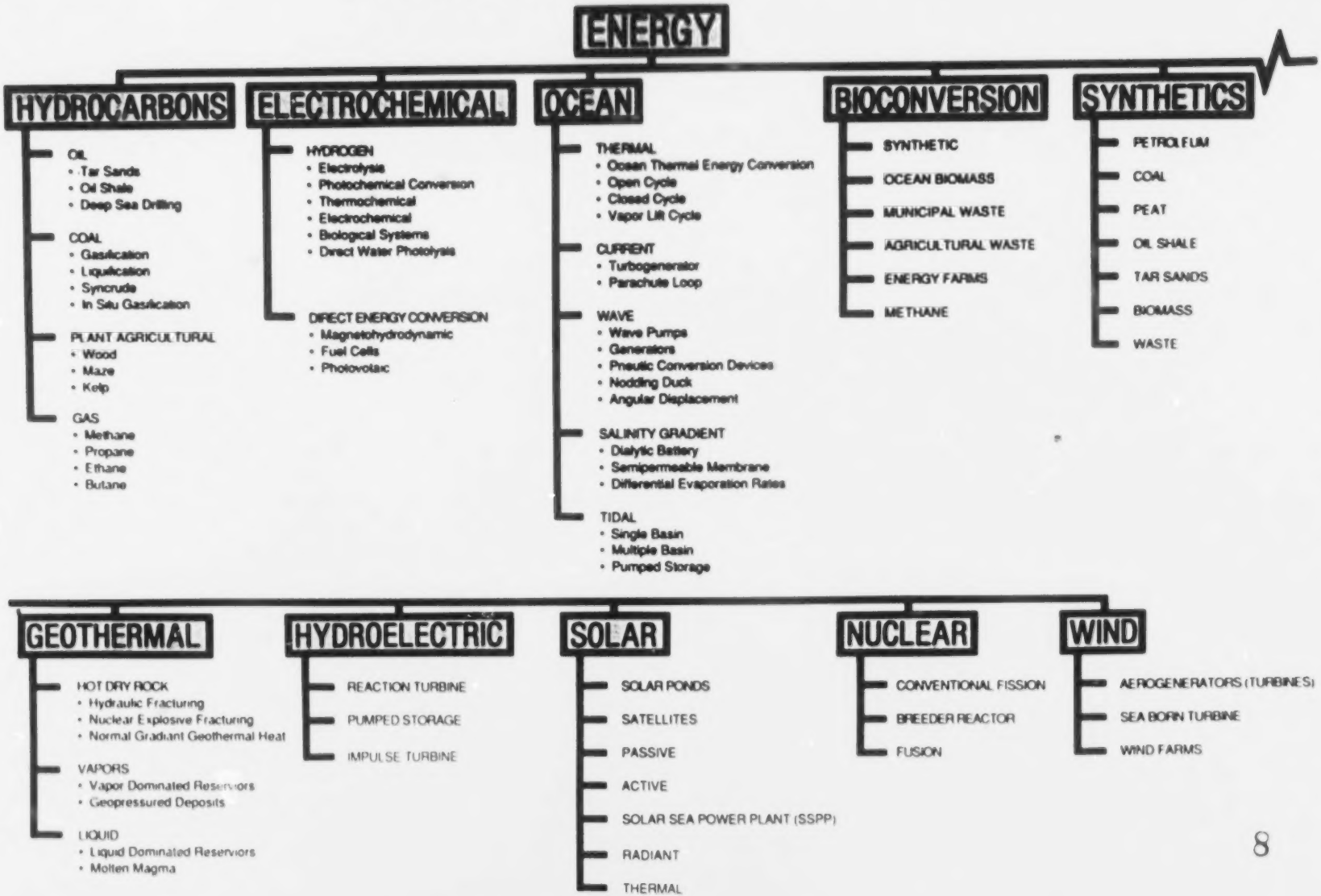
TECHNOLOGICAL ALTERNATIVES



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Goals

The program has these goals:

- Demonstrate sensitivity to the role that technology can play in solving the pressing problems facing society.
- Identify societal problem areas in which technology can play an important role in their solution.
- Identify technology alternatives in the development of solutions to problems facing society.
- Select a technological solution to a societal problem, construct a model, and make a report on the contributions the alternative makes towards the solution of the societal problem.
- Discuss the principles of mathematics and science involved as well as the economic, social and environmental impacts of the alternative. Selected by the individual.
- Write a report, present it to the class in a seminar, and respond to questions raised by class members.

Instructional Strategies

The best approach to the Technological Alternatives program is a total class methodology centering around the unit strategy for teaching. The unit strategy is supplemented with the seminar as a means of communication and for cross-fusion of ideas.

The unit strategy in this instance would involve the students in the following procedure (see also Figure 2).

Class Selects Broad Topic

A broad general topic would be selected from the problem areas. (Example: "technological alternatives in the area of energy development") The students select topics from the areas of energy, water development, housing, trash and waste disposal, etc., listed previously.

Students Select Specific Topic

Each student would select a particular technological alternative as their project and contribution to the class study of (using the previous example) energy. Under this broad topic, possible student selections include:

- Wind generation
- Hydroelectric
- Fossil fuel
- Gasification of coal
- Ocean wave
- Fuel cells
- Electrochemical
- Gas generation
- Coal liquification
- Bioconversion
- Solar energy
- Nuclear energy

Students Research Their Topic

Students then would investigate the historical background, development, current status and research future prospects of the topic they selected. Research need not be confined to the school library, in fact should not even be confined to published media. Other sources of information are listed in the resource section at the end.

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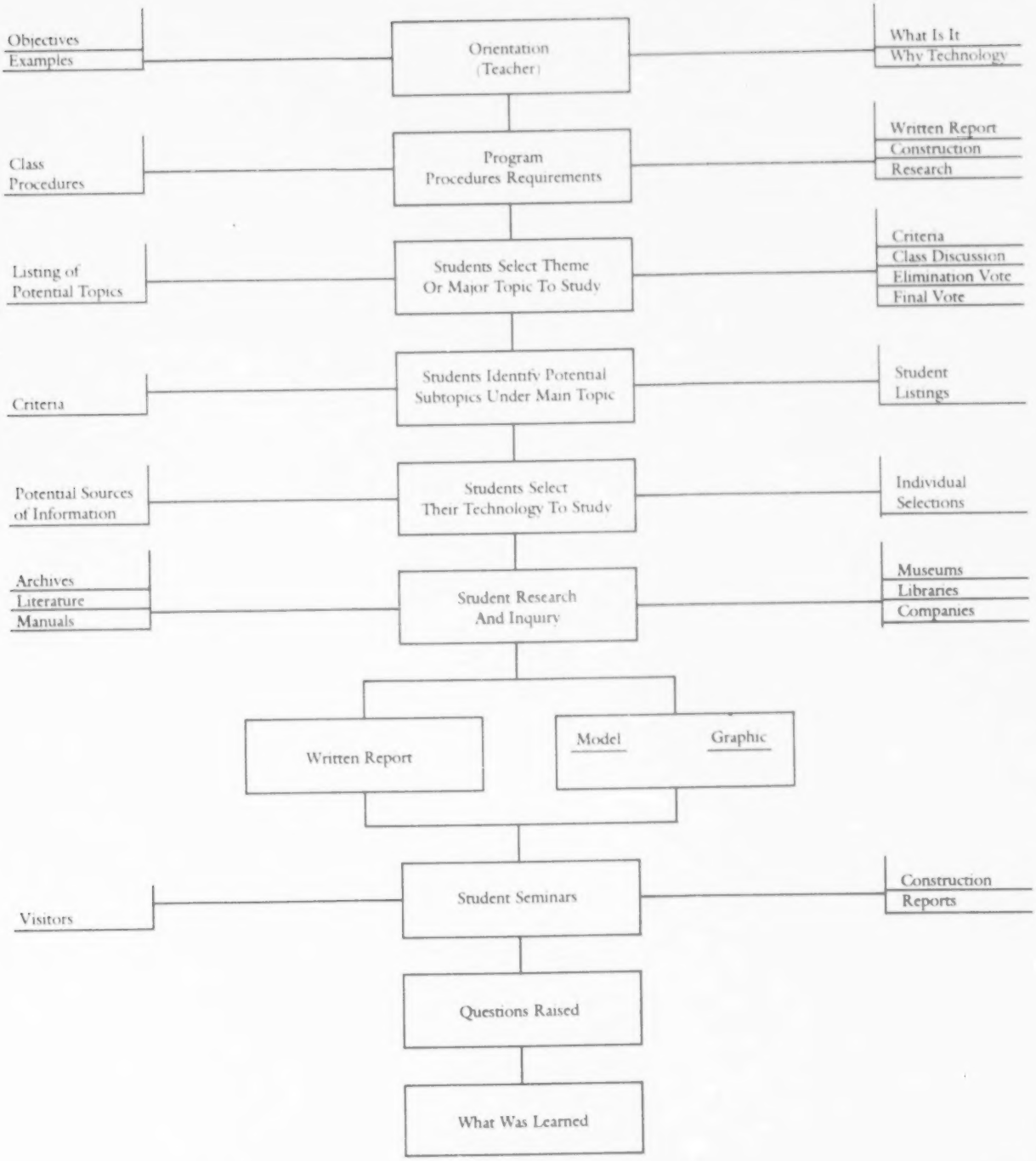

Objectives
Examples
Orientation
(Teacher)
What Is It
Why Technology
Class
Procedures
Program
Procedures Requirements
Written Report
Construction
Research
Listing of
Potential Topics
Students Select Theme
Or Major Topic To Study
Criteria
Class Discussion
Elimination Vote
Final Vote
Criteria
Students Identify Potential
Subtopics Under Main Topic
Student
Listings
Potential Sources
of Information
Students Select
Their Technology To Study
Individual
Selections
Archives
Literature
Manuals
Student Research
And Inquiry
Museums
Libraries
Companies
Written Report
Model
Graphic
Visitors
Student Seminars
Construction
Reports
Questions Raised
What Was Learned

Students Plan And Construct A Model

As part of their research, students should compile information that will help them construct a model that relates to the topic they selected. The grade level this program is taught at will determine the complexity of the model constructed.

Students Prepare A Report

In the next step, the students organize their research into a report on their individual topic. Elements of the report include:

- Title
- Purpose (student's reason for selection)
- Description of the particular technology
- Drawing, sketch or schematic of the item
- Scientific principles involved in the operation of the item
- Contributions of the technology
- Social impact
- Environmental impact
- Technological assessment including the pluses and minuses associated with the technology

Student Seminars

Finally, a series of student seminars are conducted. These seminars:

- Provide a system of communication and cross-fusion of ideas
- Provide a forum for students to present their work and report to the total class.
- Provide a mechanism for students to help each other identify problems, and clarify information.
- Develop leadership and communication skills.
- Develop a feeling of self-worth among the students.

Seminar Format

The seminar format or agenda varies with the progress of the students through the experience. Early seminars are "Progress Seminars" and the agenda would include:

- Introduction by Chairman
- Individual Progress Reports
- Statement of Titles and Problems
- Analysis and Discussion
- Items of Interest
- Closing Comments

The emphasis in these early seminars is student progress as well as any problems encountered. The other students in the class are encouraged to assist in problem solution for individuals having such.

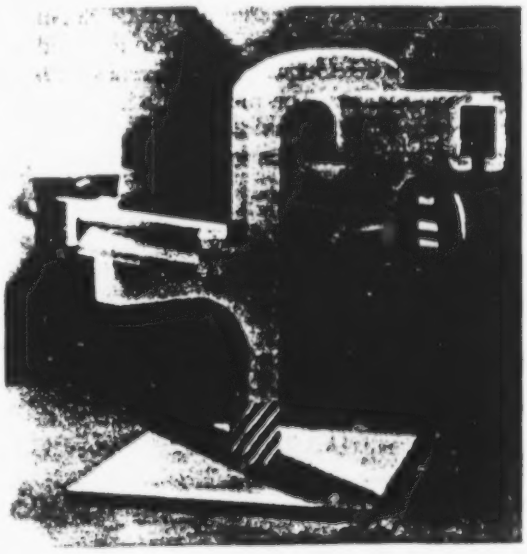
The second level of seminars is called the "Comprehensive Seminar." Limited—and generally incomplete—reports are made by one or two students at these seminars. The agenda for the comprehensive seminars is:

- Introduction by Chairman
- Individual Progress Reports
- Comprehensive Reports
- Analysis and Discussion
- Presentation of Individual Problems
- Items of Interest
- Closing Comments

The last or third level of seminars is called the "Final Seminar." These seminars are conducted as soon as students begin to complete their projects and reports. One or two students make final presentations at these seminars. The agenda for this level of seminar is:

- Introduction by Chairman
- Final Presentations
- Analysis and Discussions
- Items of Interest
- Closing Comments

The "items of interest" in each of the levels of seminars is an opportunity for the student to discuss technological items or news related to technology that are in the newspapers, magazines, or other media. It is a very important element of the seminars and was initiated by the students in the public schools.



Other Methodologies

The technological alternatives approach may involve other forms of instructional format. These include the individual project, the groups project, and research and experimentation/development.

Individual Project

In the individual project format students select certain technological innovations or developments to be constructed. Each student selects a particular item of interest to them. The degree of integration of the individual student's work into a total class effort at developing understanding would be up to the teacher conducting the program.

Group Project

The format for the group project approach involves the total class in the construction of a large model or prototype of a particular technological innovation or concept aimed at a solution to a problem area. This format follows the class organization procedures for such group process activities.

Research and Experimentation/ Development

The research and experimentation/development format involves individual students in the conduct of research or development with different aspects of a problem solution. This process also includes student research, construction, testing, evaluating, writing a report, and class seminar presentations.

Student Productivity

The Technological Alternatives program is a combination hands-on, cognitive approach to the development of technological literacy of the options available for some of society's pressing problems.

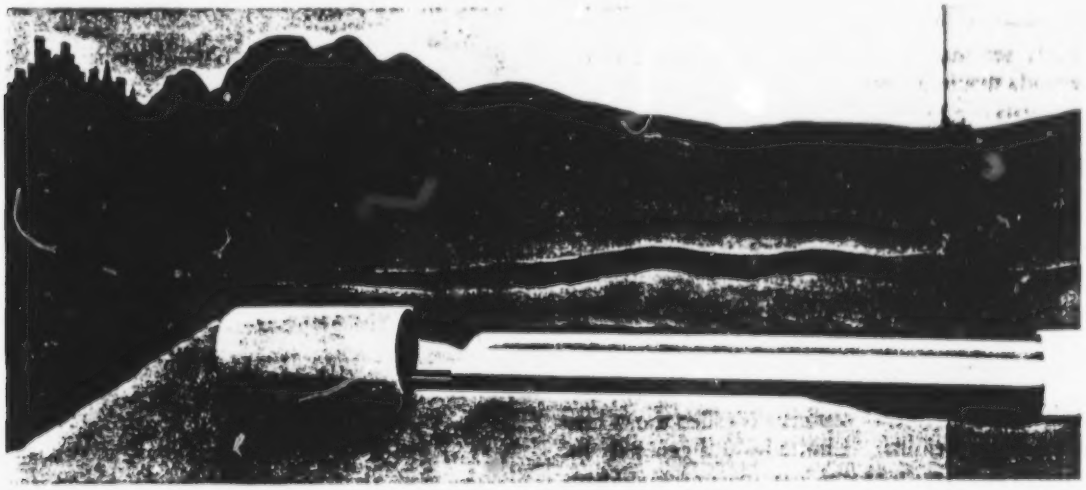
Two types of tangible student products are produced:

First, the student produces a physical model or detailed graphic representation of the particular alternative he/she has chosen as a contribution to the total unit study. Such production involves the following activities:

- Decision making
- Problem solving
- Inquiry
- Reading
- Planning
- Drawing
- Constructing
- Organizing
- Evaluating
- Communicating

The other student product is a written report as previously discussed. This report involves the student in a variety of activities including:

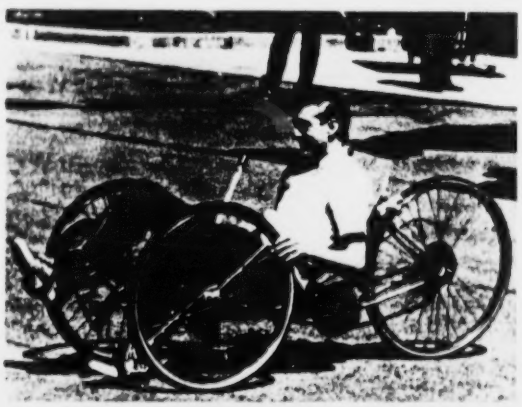
- Researching
- Writing
- Inquiring
- Verbal reporting
- Planning
- Organizing
- Reading
- Thinking

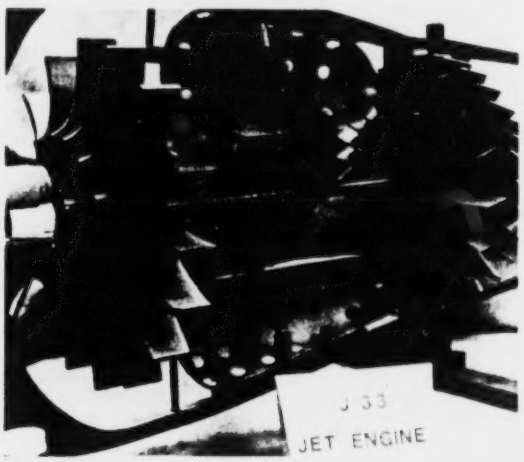


Student Development

The program productivity also includes personal and human qualities that are important in an advanced technological age. These include:

- Developing attitudes towards technology
- Making assessments of technology
- Developing resourcefulness
- Developing communication skills
- Developing problem-solving capabilities
- Sharing ideas and helping others
- Developing manipulative skills
- Developing organizing skills
- Developing a positive self-image
- Developing thinking and rationalizing skills





Interdisciplinary Potential

The Technological Alternatives program is a natural for interdisciplinary study. The breadth of understanding required to make effective choices in the areas of energy, water development, trash and waste disposal etc., makes it imperative that such a study involve a number of disciplines. A study of technological alternatives would surely involve such dimensions as social and environmental impact, economics, government, geography, science and mathematics. The home base for such a study would be in the technology education laboratory.

The interdisciplinary approach may take different forms:

- The teacher may elect to have the teachers of other disciplines—social studies, economics, government, science, mathematics and geography—come into the class as guest presenters.
- The students in the class may consult with the teachers of the several disciplines as is necessary.
- An extended collection of appropriate references from the several disciplines may be kept in the laboratory reference files or in the laboratory planning center.
- Team teaching is a good procedure for interdisciplinary study, but may not always be possible in the usual school organizational plan.
- The interdisciplinary activities might also involve persons from the community who are knowledgeable in a given discipline.
- Local college and university personnel may also be invited to participate in such interdisciplinary studies.

Interdisciplinary involvement may be achieved through a variety of questions that are appropriate when studying technology. Such questions include:

- What are the alternatives?
- What are the social impacts?
- What are the environmental impacts?
- What are the costs involved?
- Who should pay for it?
- What governmental regulations are involved?
- What is the long-term impact?
- What if?
- What mathematics are involved?
- What science is involved?

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Resources

The information resources for the Technological Alternatives study take the form of people, reports, books, magazines, video recordings, movies, governmental agencies, corporations, and technical presentations.

- People involved in research as well as development of specific alternatives represent a good source.
- National governmental personnel represent a good source. On the federal level this could include contacts with the Department of Interior, Department of Commerce, Department of Energy, Department of Transportation, Department of Labor, Department of Defense, Federal Aviation Administration, National Aeronautical and Space Agency, and many more.
- Local governmental agencies are another good source. This would include city, county and state governmental units related to the specific technology being studied for its alternatives.
- Companies and corporations that construct, maintain or operate components under consideration would be another good source of information.
- Local libraries as well as libraries associated with private technical and professional associations may prove valuable.
- Local universities and colleges may have personnel as well as literature sources that could prove useful.

ITEA has a number of background resource materials available. A complete listing of available materials is listed in the ITEA Catalog.

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Technology in Our Community

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Donald Maley

Professor Emeritus, University of Maryland
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It is important to note that the conduct of such programs centers around a number of popular issues in contemporary education. Emphasis is placed on experiential and first-hand learning in practically all areas of the programs. Problem solving and inquiry are essential along with the integration of mathematics, science, social studies and environmental studies.

Another important element of such programs is that the laboratories as found in most schools at the middle, junior and senior higher levels can be used for the construction/experiential aspects without any significant change. This is not to say that modern technology and computers would not be useful. The issue is that one should not put a major laboratory rennovation as an obstacle to the carrying out of what can be a true and exciting study of technology.

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Figure 1 was developed by Stephen Petrina, a student in the Department of Industrial, Technological and Occupational Education at the University of Maryland, College Park.

Introduction

The Technology in Our Community program is of primary importance in the quest for technology literacy. Beyond the technology in our homes, it is the technology in our communities that provides much of the comforts and amenities of living in this latter part of the 20th century.

The technologies associated with the water supply, energy, transportation, communications, health services, entertainment, traffic control, sewage disposal, trash and sanitation control, and recreation are some of the more obvious applications of technology related to living and working in practically every community. Additionally, there are the many technologies in industry and business operations as well as those associated with our multi-level educational systems.

Another way to look at the issue is to try to imagine our communities—whether large or small—without modern technology. Imagine your community without power, health services, transportation facilities, fresh water, sewage and waste disposal, fuel, radio, telephone, television, newspapers, traffic control, etc. Our communities even with their present populations would disintegrate and cease to exist without the contributions of technology.

The objectives of this program are:

- To create a greater awareness of the presence of technology in our daily living;
- To understand the importance or significance of technology in its various dimensions to our communities and their functioning; and
- To develop some operational and functional knowledge of and/or skill in the use of technology in the community.

Such a program is one of enlightenment or learning for citizenship and living in an advanced technological society.

Don Maley

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Technology in Our Community

The Technology in Our Community program is a unique approach to the study of STS as well as an excellent opportunity to develop a greater degree of technological literary. It also is an opportunity to increase students' awareness of the role and significance of technology in their daily life.

The program deals with the vast array of technology found in the community where the student lives. Such technology includes that associated with such elements as: transportation, communication, industry/manufacturing, community services, waste disposal/sanitation, environmental control, agriculture, energy/power, administration and finance. Figure 1 illustrates some of the uses of technologies common to most communities.

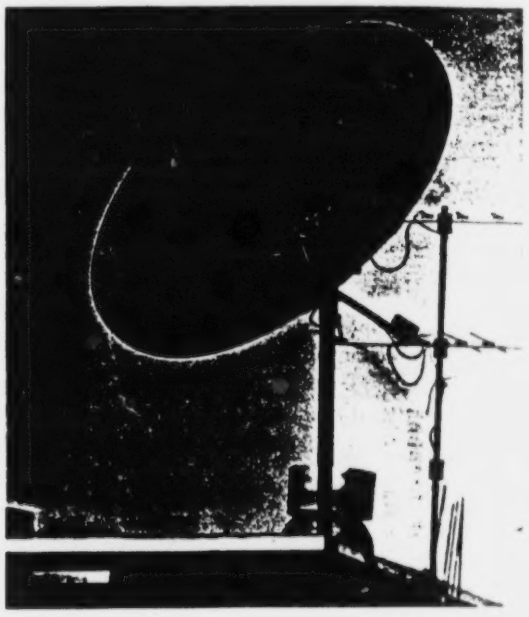
This program is an excellent example of how the immediate environment of the school can be the center of a rich educational experience as well as a source of valuable understanding for the student. It is a program focusing on technological literacy in a direct and relevant manner. Such a program takes the school out into the community and brings the community into the school.

The program's content is related to the areas of technology listed above and shown on Figure 1. The activities associated with this program include the construction of models and/or graphics of various technologies in the community. Other educational experiences could include field trips, guest speakers, seminars, student inquiry at a variety of community agencies, student reports, future projections for the use of technology, and an analysis of problems facing the community that may have implications for applied technology.

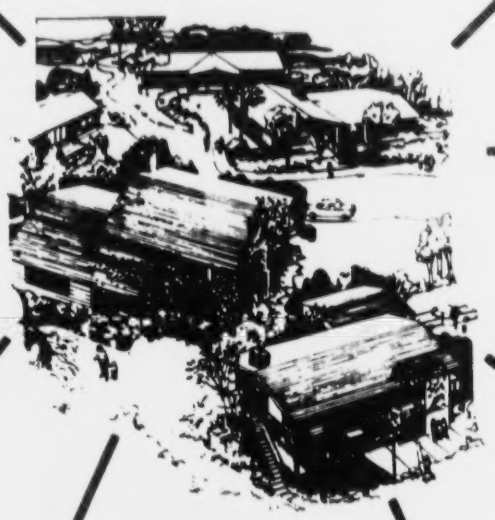
Unique Features

There are a number of unique features of the Technology in Our Community program including:

- The content and substance of the program are associated with and derived from the immediate environment of the student.
- The student has daily contact and interaction with the technologies under study.
- Information sources related to the various technologies are located in the community in the various businesses, institutions, agencies and units providing the technology.
- The impact of the technologies in the community are felt on a daily and consistent basis, thus making such study more meaningful and relevant.
- The program provides future citizens (students) with a basic introduction to a major area of concern for their community and its future.
- The program provides an excellent opportunity for studies in technological assessment on a first-hand basis.
- The program deals with major areas of reality in a living/learning involvement with a content that affects each student's daily life.



Technology Around Us: The Community



Transportation

Vehicular
Rail
Air
Rapid Transit
Materials/Resource Handling
Traffic Control
Terminals/Stations
Parking

Administration/ Finance

Record Storage/Access
Data Exchange
Information Processing
Bank Management
Electronic Teller
Security

Environment/ Agriculture

Air Quality Control
Watershed Control
Drainage
Pesticide Control
Land Preparation
Cultivating/Harvesting
Irrigation
Land Reclamation

Waste Disposal/ Sanitation

Waste Management
Sewer System
Sewage Treatment
Garbage Collection
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Community Service

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Communication

Radio
Television
Telephone
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Short-Wave Radio
Newspaper

Energy/Power

Power Generation
Electrical Transmission
Natural Gas Pumping
Petroleum Refining
Processing/Distribution
Resource Extraction
Lighting Systems

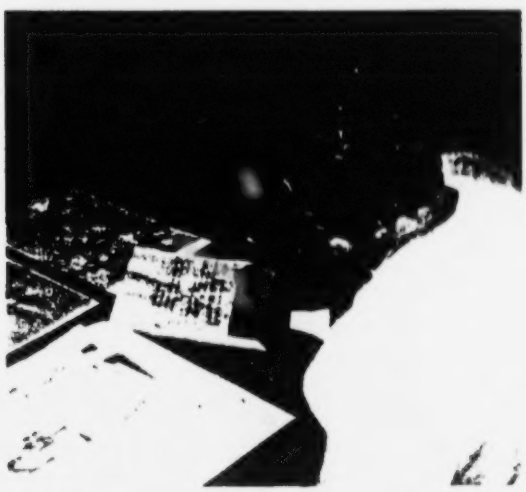
Grade Levels

The Technology in Our Community program could very easily be conducted at the elementary, middle or secondary levels. It also would make an excellent study for adult education and citizen awareness programs.

At the elementary level, the program could be used to develop students' awareness of technology and the role it plays in the community. It could be a part of a larger theme such as "Knowing our Community."

At a middle or junior high school, the program can do a more in-depth study of the various technologies in the community because of the laboratories generally there. Studies could explore individual interests, self-exploration, physical coordination, or any form of active learning situations dealing with the technologies in the community. The program could be a combination of awareness and application studies of technology found in the community.

At the senior high school level, the program could take a number of different approaches. These might include: dealing with technology assessment studies, technological timelines, technological alternatives studies, or futuristic technological developments for the community. The pivotal position that the high school has in the development of citizens in a democracy delineates a key role for this component of our educational system. One dimension of this role is the development of citizens capable of making decisions and contributing to an advancing technological society.



Goals

The Technology in Our Community program has potential application at all levels of schooling. Suggested goals for different levels are:

Elementary Level

The goals of the Technology in Our Community program in the elementary school include:

- Develop an awareness of the different technologies in the community.
- Develop an awareness of the contributions technology makes to the life and functioning of the community.
- Develop an appreciation of the role that various technologies in the community play.
- Develop a sensitivity to the changes that have occurred in the community due to technological innovation.
- Develop a sensitivity to the safety factors associated with the use of technology in the community.
- Develop manipulative skills in working with certain elements of the technology in the community.

Middle Level

The goals of the program in the junior high school or middle school include:

- Develop a broad perspective on the role of technology in the evolving civilizations, past and present.
- Develop a capability in inquiry and problem solving.
- Develop an understanding of the social and environmental impacts of technology.

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- Develop an increased understanding of the changes occurring in technologies in the community.
- Develop an understanding of the benefits and risks of choosing technologies.
- Develop skill in using a variety of technologies and materials.
- Develop the ability to learn, locate, and process information for useful purposes.
- Develop an awareness of and need for a process of technology assessment for influencing the choice of technologies in the community.

Secondary Level

The goals of the program in the high school include:

- Develop the ability to learn and to process information.
- Develop the ability to analyze, inquire, and solve problems.
- Understand the alternatives to major technological problems facing the community.
- Develop an understanding of the social and environmental impacts of various technologies in the community.
- Develop an understanding of and process for making technological assessments related to the community and its use of technology.
- Develop an understanding of the relationships to, as well as impacts of, technological decisions and human values.
- Develop an awareness of the changes taking place in the community because of technology.
- Develop a multi-disciplinary approach to the study of issues involving technology.
- Develop skill in the selection and use of technologies.
- Develop a sensitivity to the benefits and risks in choosing technologies.

Instructional Strategies

The Technology in Our Community program can involve a variety of instructional strategies including the group project, the unit or integrated approach, and the problem-solving approach.

Group Project Format

The group project format is a natural for the study of the Technology in Our Community. Such a group process could include a study of the community as a whole with all of its various technological systems, or it might be a group process study of only one technological system.

The total community group project might involve a large diorama of the community or a major segment of it. Such a model could be to scale and include the various technological systems of water supply, trash disposal, power generation, communication systems, transportation systems (highway, subway, railroad, elevated way, airport, heliport, waterway, etc.), water purification, industrial development, business development, community services, recreation facilities, and housing.

The range of topics and areas of study might include:

- Environmental problems and solutions.
- Traffic and transportation flow and improvement.
- Means of enhancing living conditions in the community.
- Location of selected technological systems.

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- Pollution control concerns and recommendations.
- Community growth and technological needs.
- Community improvements and technological implications.
- Social, economic, environmental and technological interface in the functioning of the community.

The single technological system in the community group project approach could involve a total class concentration on any one of the systems (water supply, transportation, power generation, communications, etc.) listed previously. This would also involve construction and design of a model of the particular system selected by the class. Such a model could include working units, animation, electronic controls, appropriate graphics, and various forms of simulation.

The topics for study in such a group project experience might include:

- Personnel required to operate and maintain the system.
- Analysis of technologies integrated into the system.
- Social and environmental impact of the system.
- Alternative systems that may be used to perform the function.
- Pollution control measures that may be necessary or advisable.
- Processes involved in the operation of the system.
- The technological evolution of the system.

Unit Approach

The integrated or unit approach to the study of technology in our community is well suited to an organismic or holistic study of the community in terms of its technological systems. Such a study might center around the following topics:

The Technological Evolution of Our Community—This could be based on a timeline analysis of when selected technologies were introduced into the community. The strategy would involve having each student (or pairs of students) select a particular technology or system for study and presentation to the class. Study could follow the contract method with each student or pair of students contracting to be responsible for a particular part of the overall topic.

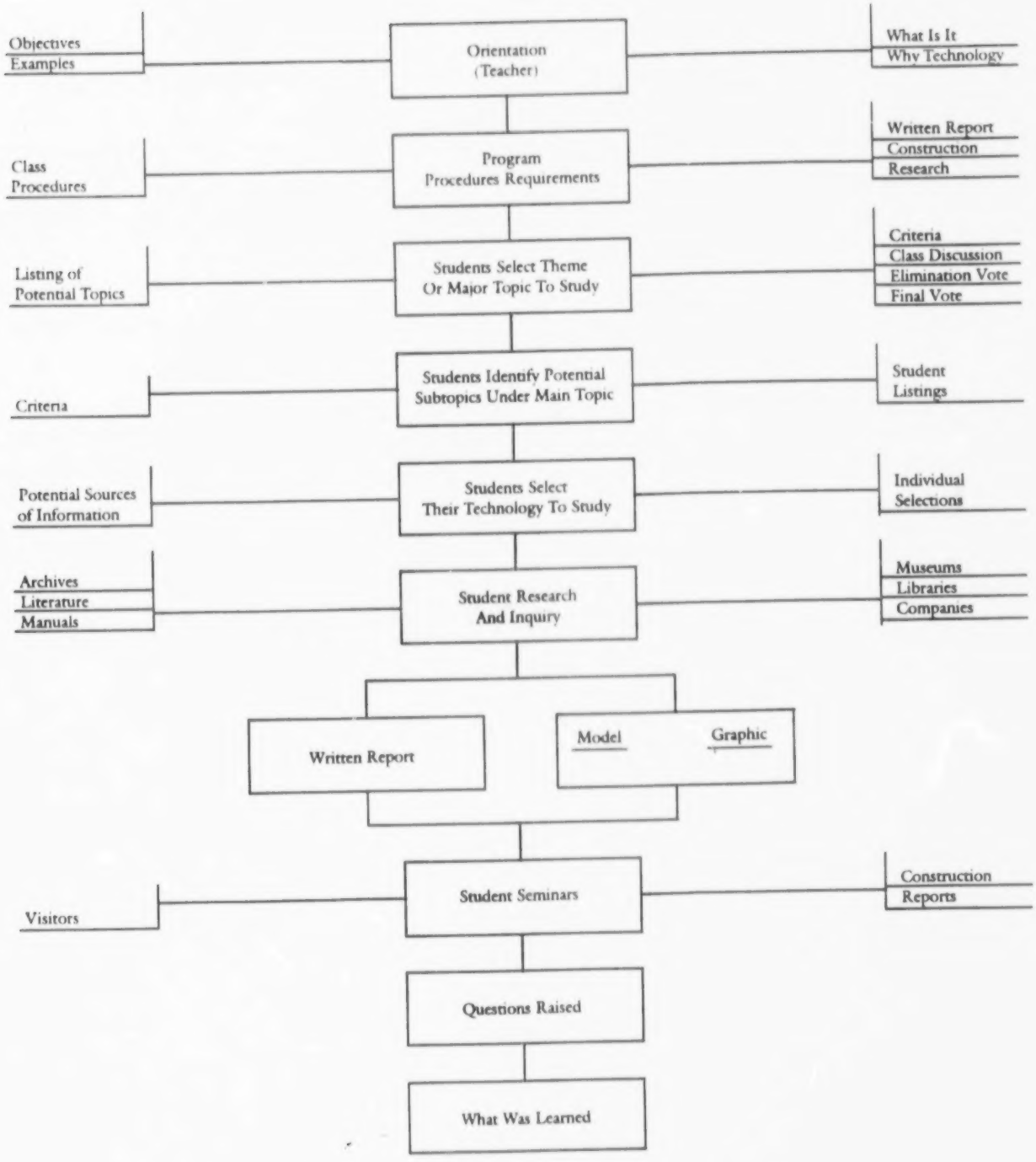
Technological Systems that Contribute to Life and Living in Our Community—This could involve each student or pairs of students taking a particular technological system such as air transportation, water transportation, land transportation, water supply, sewage control, power generation, radio communications, traffic control, and so on as a segment of the total topic for which they would be responsible to present to the class.

Pollution Control Needs in Our Community—This could involve each student or pairs of student taking a particular area or segment of the community where there is a possibility of pollution and studying it for presentation to the class. This might include such individual areas of study as—noise pollution, water pollution, air pollution, industrial waste, trash and waste disposal, sewage disposal, hydrocarbon emission, automobile emissions, water runoff, chemical dumps, landfills, etc.

In pursuing their topic, each student or pair of students would prepare a written report, construct a model or mockup and/or an appropriate graphic display. These materials would be presented at seminars organized and conducted by the students.

Problem-Solving Approach

The problem-solving strategy is a third form of instructional procedure that is effective for studying technology in our community. This approach in-


Objectives
Examples
Orientation
(Teacher)
What Is It
Why Technology
Class
Procedures
Program
Procedures Requirements
Written Report
Construction
Research
Listing of
Potential Topics
Students Select Theme
Or Major Topic To Study
Criteria
Class Discussion
Elimination Vote
Final Vote
Criteria
Students Identify Potential
Subtopics Under Main Topic
Student
Listings
Potential Sources
of Information
Students Select
Their Technology To Study
Individual
Selections
Archives
Literature
Manuals
Student Research
And Inquiry
Museums
Libraries
Companies
Written Report
Model
Graphic
Visitors
Student Seminars
Construction
Reports
Questions Raised
What Was Learned

volves having individual students or small groups of students identify a problem area in the community that needs resolution. This resolution should involve some form of a technological fix.

Examples of potential problem areas for investigation include:

- Improvements at the airport
- Traffic control throughout the community
- Flood control measures
- Increased noise pollution control
- People-mover needs
- Rapid transit needs
- Trash and waste disposal
- Pedestrian safety
- Sewage treatment
- Air pollution control
- Water pollution control
- Fire and disaster control

Each of the problem areas should be dealt with in a holistic, integrated manner with implications for health, safety, economics, environmental impact, social impact, and the technical means for solution. Construction of models, mockups, and/or appropriate graphics could be required along with a written presentation of the problem and its resolution.

The procedure used in the attack on the problem should be clearly outlined along with all problem-solving processes. The heart of this methodology is the system of inquiry and problem solving used by the students.

The individual or small group presentations of their written reports and models/graphics would be carried out at student-organized and conducted seminars.

Figure 2 shows general procedures that are suggested for the program. This is with special reference to the group projects and the unit or integrated approaches. The problem-solving strategy would involve only minor adjustments in the procedure as presented.

Student Productivity

The issue of student productivity in this program is dependent on the grade level in which it is run. Productivity in this context centers around the kinds of things (reports, projects, graphics) the students would produce.

Elementary

On the elementary level, the program would focus principally on technological awareness in the community and would center around such student involvement as:

- Identifying various technologies (systems) that help provide our community with its daily needs.
- Discussing the contributions the various technologies (power plant, water works, airport, radio station, etc.) or systems make to the community.
- Drawing a map of the community with a number of the technologies located on it.
- Developing vocabulary related to the various technologies.
- Making a diorama of the community with the various technological systems in place.
- Making drawings or sketches of the various technological systems.
- Making models of various technologies from cardboard, wood, metal or plastics.
- Reporting to the class on selected technologies.
- Writing reports on the use, importance, and operation of the various technologies.

Middle Level

At the middle level, the study of Technology in Our Community would have more depth and involve more productivity because of the availability of a laboratory and the increased written, verbal and manual skills of the students at this level. Some of the items or areas of productivity that might be expected at this level include:

- Developing written reports related to selected technologies in the community.
- Constructing models representing technologies in the community.
- Constructing a model of the community with the various technological systems located on it.
- Developing a seminar agenda.
- Developing drawings or other graphics depicting various technological systems in the community.

- Developing a large scale map of the community with the technologies in place.
- Making a display of photographs showing the various technological systems in the community.
- Making a videotape complete with narration on the topic: "Technology in Our Community."

Secondary Level

In the high school, a Technology in Our Community program has considerable relevance, meaning and significance for the young adults who are or soon will be voting citizens dealing with the many diverse issues of the community. The productivity of the students at this level of maturity and responsibility should reflect their emerging status as citizens. Some of the forms of productivity at this level include:

- Participating in a group effort that would produce a scale model of the community.
- Participating in a problem-solving activity related to selected issues in the community and preparing a written report.
- Constructing working or static models of technological systems in the community.
- Writing reports on the function and implications of a selected technology.
- Developing a seminar agenda for the class.
- Creating a display of selected technologies in the community.
- Making a videotape for presentation of the technology in the community.
- Writing a technological assessment of various systems in the community.
- Developing a series of technological alternatives to some of the existing technologies in the community.
- Developing recommendations (based on study and research) for improving selected technologies (systems) in the community.

Student Development

This section deals with the personal-human growth factor that may come about as a result of actual and full participation in the Technology in Our Community program. Such development is identified as appropriate for each of the three levels at which the program may operate.

The personal-human growth that may develop at the elementary level for the program would include:

- Increasing the students' vocabulary.
- Broadening the students' awareness of the role of technology in the community.
- Improving the students' verbal and written communications.
- Improving the students' manipulative skills.
- Developing a positive attitude towards technology.
- Developing hand and eye coordination.
- Stimulating the individual's curiosity about how things work.
- Developing a sense of accomplishment in the individual.

At the middle level, the Technology in Our Community program's contribution to the personal-human growth would be expected to include:

- Increasing the students' communication capability.
- Improving students' manual/manipulative capabilities.
- Broadening students' background and sphere of interests.

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- Establishing independence in thinking and actions.
- Increasing students' vocabulary.
- Establishing a positive self-image.
- Developing social skills and relationships.
- Having a sense of accomplishment.
- Integrating mathematics and science into the study of technology and its applications.
- Developing problem-solving skills.

At the senior level, the Technology in Our Community program's contribution to the personal-human growth would include:

- Broadening interests in various forms of technology.
- Developing and improving problem-solving skills.
- Developing skills of inquiry, analysis and decision making.
- Developing greater career awareness.
- Developing social and interpersonal relationships.
- Developing communication skills.
- Developing technical capabilities.
- Developing social and environmental impact awareness relative to the use of technology.
- Increasing understanding of science and mathematics through their application in technology.
- Increasing awareness of the role of technology now and in the future.

Interdisciplinary Potential

The Technology in Our Community program in Technology Education is a natural for the integration of subject areas such as health, safety, mathematics, science, social studies, environmental studies, history, economics, government, politics, and communications. The strength and value of this integration potential is tied in with the relevance of such studies to the immediate environment and the lives of the students in the community. It is an excellent opportunity for a holistic learning design.

The interdisciplinary involvement in this program might take the following forms:

- Verbal and written communications through presentations in class.
- Written communications through reports developed for the program.
- Analyzing problems associated with the operation of various technological systems in the community.
- Interpreting science concepts related to the functioning of selected technologies.
- Interpreting mathematical applications related to the work and functioning of selected technologies.
- Making cost analyses of various technologies.
- Making timeline presentations of changes in technologies in the community.
- Making technological assessments of selected technologies in the community.
- Analyzing how technology has changed life in the community.
- Analyzing the positive outcomes of technological systems in the community.
- Analyzing negative outcomes of technological systems used in the community.
- Projecting future implications for technologies in the community.
- Analyzing the social impact of the various technologies in the community.
- Analyzing the environmental impacts of the various technologies in the community.

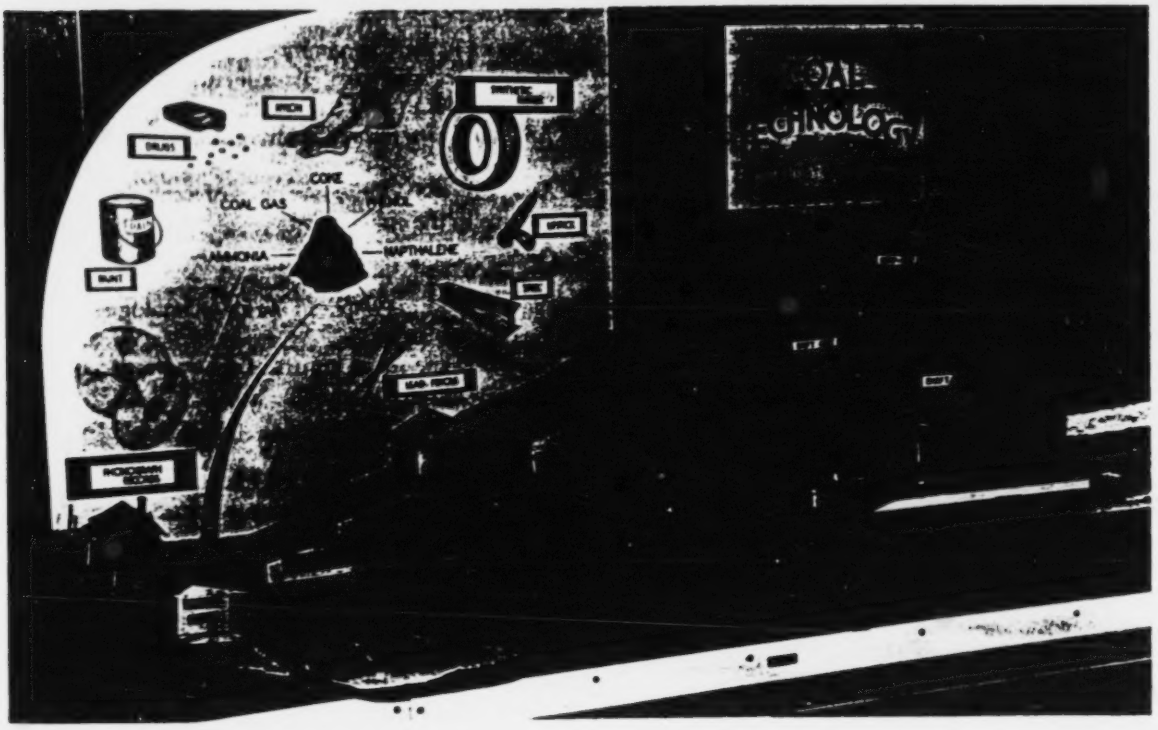
The degree and nature of the integration of subject matter or interdisciplinary involvement will vary by the different levels of schooling (elementary, middle and secondary). It also will vary in accordance with the nature of work done in the program such as group projects, problem solving or the unit/integrated format.

Resources

There are a variety of sources upon which the Technology in Our Community program may draw. These include people, library resources, technical publications, and commercial industrial publications. The following list contains some of the sources students may draw upon for assistance.

- Practically every technological system (water, power, sewage, etc.) has personnel who could make presentations to the students.
- The city council or other official governing body has people on it or employed by it who could assist or serve as resource persons.
- The various technological system locations can be a source of valuable field trips. This includes transportation centers, airport, power plant, water works, etc.
- The various technological systems receive a broad range of technical publications that would be of value to a class engaged in such a study.
- Corporations and businesses that service the various technological systems can provide quantities of information by way of a phone call or mail request.
- Technical manuals associated with the maintenance, operation, and repair can be secured from the respective technological systems.
- Public personnel charged with planning, controlling, and inspecting such technological systems are another source of guest speakers as well as written information.
- Personnel from local universities and institutions of higher education represent another valuable source of information.
- The local public libraries are another source of information on such technologies.
- State and federal regulatory agencies associated with the design and operation of such systems represent an excellent source of information that is frequently not used.
- ITEA has several items that may be useful to the teacher as well as the student. For example, its "Technology Resource Package" contains such information.

There is practically no limit to the kinds and availability of information in the areas of technological systems in the community as identified in this program. It also provides an excellent arena for the students to develop their capabilities in inquiry, resourcefulness, communications, and learning to learn.



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Technology in Our Homes

A Part of the
SCIENCE/TECHNOLOGY/SOCIETY
RESOURCE PACKAGE

Donald Maley

Professor Emeritus, University of Maryland
and Senior Fellow, ITEA

International Technology Education Association
Reston, VA

Preface

This publication is one of a number of efforts by the International Technology Education Association to help broaden individual teacher's perspective on the range of potential content and programs for Technology Education, as well as Science, Technology and Society (STS). This material provides basic instruction and information that would be useful in the conduct of inter-disciplinary studies involving Technology Education classes along with such areas as economics, social studies, history, mathematics and science. These materials may also be used by the Technology Education teachers in their development and conduct of programs that are new and innovative.

It is important to note that the conduct of such programs centers around a number of popular issues in contemporary education. Emphasis is placed on experiential and first-hand learning in practically all areas of the programs. Problem solving and inquiry are essential along with the integration of mathematics, science, social studies and environmental studies.

Another important element of such programs is that the laboratories as found in most schools at the middle, junior and senior higher levels can be used for the construction/experiential aspects without any significant change. This is not to say that modern technology and computers would not be useful. The issue is that one should not put a major laboratory rennovation as an obstacle to the carrying out of what can be a true and exciting study of technology.

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Figure 1 was developed by William Falatko, a student in the Department of Industrial, Technological and Occupational Education at the University of Maryland, College Park.

Introduction

The Technology in Our Homes program is fundamental to living in an advanced industrial society. The home abounds with technologies that have advanced from some very simple, easy to understand items to those of the present home that are complex and beyond the understanding of most members of the household.

Technologies in the home have also affected the nature of food preparation, life styles, entertainment, information access, personal comfort in all climates, protection from various intrusions, and communications over a broad spectrum. The modern home is made up of a variety of technological systems as well as endless appliances that have had a variety of subsystems and controls. The automated nature of many technologies used in the home also helps develop an appreciation of how machines and devices control other machines or functions.

The intent of this program is not to develop repairmen or technicians. The goal is principally technological literacy so that during our lives in the midst of a jungle of technologies and technological systems we have some level of understanding, some level of ease in the environment, and gain some level of control over the house in which we live.

The program is ideally conducted at the early grade levels as well as in adult education classes.

Donald Maley

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Technology in Our Homes

Technology in Our Homes is an approach to the study of technology or science/technology/society. It is based on the concept that technology plays an important part in the functioning of the physical dimensions or elements of the home—heating, cooling, regulating, lighting, cooking, cleaning, entertaining, and communicating. As such "home" is a basic starting point for the development of technological literacy.

This educational program uses the technology commonly found in the home to develop an understanding of and familiarity with the technological innovations that have added to the comfort and efficiency of the modern home. Figure 1 illustrates some of the kinds of technologies commonly found in the home.

Unique Features

The unique features of the Technology in Our Homes approach are:

- The technology involved is from the immediate environment of the students.
- The students study something that they deal with on a daily basis.
- The technology or technological systems dealt with are capable of being identified and to some degree controlled by the students.
- The technology used in the home is so much a part of the lifestyle of the students that its impact is readily discernible and analyzed.
- Most of the technology used in the home is of the size and complexity that it may be studied in school-based laboratories.

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Grade Levels

Technology in Our Homes is primarily conceived as an initial phase in the process of developing technological literacy. As such, it may be included in the initial experiences in Technology Education or STS courses, whether they be on the elementary school level or in middle or junior high schools.

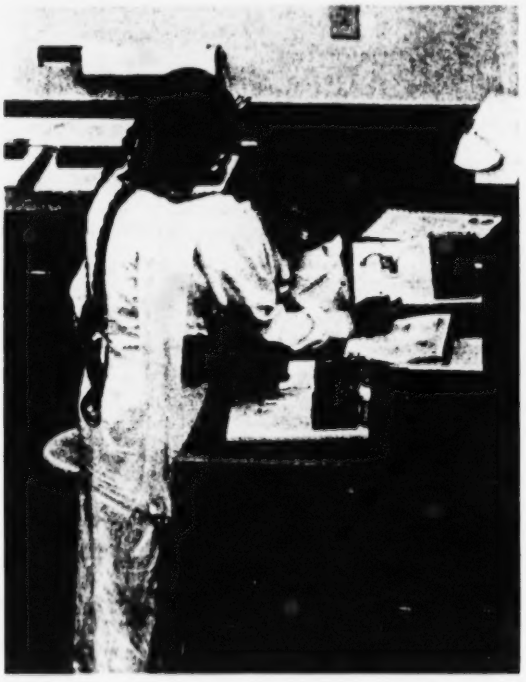
However, it may also be offered at the upper grade levels or during adult education where the purchase, co' trol, and maintenance of such technology is closely linked with ownership and use. As a component in a sequential educational program in technology education it best fits as an initial experience due to the affinity and daily contact factors.

Goals

Program goals are related to the level of the student to which the experience is directed. This is to say that the goals for an elementary grade level student would be different than those for an adult.

The following goals are suggested for the elementary level:

- Develop an awareness of the different technologies in the home.
- Develop an awareness of the contributions that technology makes to the comfort and efficiency of the home.
- Develop an appreciation of the role that technology plays in daily life.
- Develop some rudimentary understanding of the use and control of technology in the home.
- Develop a sensitivity to the changes that have occurred in the home due to technological innovations.
- Develop a sensitivity to the safety factors involved in dealing with technology in the home.
- Develop manipulative skills in working with certain elements of technology found in the home.



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Instructional Strategies

A variety of strategies are used to accomplish these goals. A list of these strategies and a brief discussion follow.

Orientation

The teacher conducts an orientation session that is directed towards helping the student understand what the Technology in Our Homes program is and why it is important to understand the technology in our homes. This opening orientation should also include the objectives of the program as well as a discussion of the kinds of technologies that are found in the home.

Awareness Session

The second phase of this program is what may be termed a sensitivity session in which the students and the teacher engage in a discussion of the topic "Technology in Our Homes." This session is aimed at helping students develop a perspective on the range and kinds of technologies found in the home. The class discussion strategy is used in this case.

Course Requirements and Procedures

The next phase is a presentation of the course requirements which would include the necessary student research and inquiry, writing a report on one of the identified technologies, and the construction of a model, a mockup or a graphic of the topic selected by the individual student. This session would also include a discussion of class procedures. This session would involve a teacher presentation with class discussion.

Identify Technologies in the Home

Next students identify the various technologies found in the home. All students are encouraged to contribute by identifying technologies that they find in their homes. These technologies are listed on the chalkboard or in a computer from which the students may proceed with the next step. Effort should be made to identify and list as many as possible. The students are then asked to suggest criteria for the selection of those technologies appropriate for study.

Students Select Technology

During the next phase, the students (individually or in pairs) select a particular technology from the listing that they will investigate and present as their contribution to the total class understanding of technology in the home. During this phase, the students also explore possible sources of information to which they may turn to do the research necessary to carry out their written reports and project development.

Research

Next the students research and inquire into the technology they (individually or in pairs) have selected. This phase of the program may take the students to the libraries of the school as well as the community, merchandising businesses, sales literature, equipment manuals, and a broad range of technical manuals.

Production

Following the research phase, the students write a report and construct a project, display, or graphic on their technology. The report might contain the following elements:

- Name of technology
- Use or function
- Sketch or photograph of the item
- Historical development
- Scientific principles involved
- Impact on family living
- Future projections for the technology
- Resources used

The physical project could take the form of a model, display, a graphic representation, or a devel-

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Technology Around Us: The Home

Entertainment

Stereo System, C.D.
Video Recorder
Television
Video Games
Electronic Toys

Food Preparation

Oven/Stove
Microwave Oven
Food Processor
Mixer/Blender
Toaster Oven

Security

Alarms
Electric Eye
Lighting
Lock Systems
Smoke Detector

Cleaning

Washer/Dryer
Dish Washer
Trash Compactor
Vacuum System
Garbage Disposal

Communications

Telephone
Intercom
Short Wave/C.B. Radio
Mail System
Computer/Typewriter

Food Preservation

Refrigerator
Freezer
Canning
Bottling
Storage Containers

Climate Control

Thermostat
Heat/Cool Systems
Fans
Humidifier
Space Heater

oped exhibit of the components of the technology being studied. Students should be encouraged to use their ingenuity in this project construction dimension of the program.

Sharing

The next stage is the planned sharing experience which takes the form of seminars. These seminars should be chaired by a student selected either on a rotating schedule or chosen by the teacher.

The agenda for such seminars generally includes:

- Introduction by student leader
- Presentation by Student "A"
- Presentation by Student "B"
- Discussion and challenges by the class regarding the two presentations
- Problems being experienced by the students in their research or project development
- Items in the media regarding technology
- Closing comments (leader, visitors and teacher) Note—Visitors are encouraged to attend these seminars.

The presentations are generally limited to two per seminar in view of the length of time in a class period. Presentations involve both the written report as well as the constructed projects.

Class Discussion

The seminars completed, the next phase of the program is a class discussion on the total class effort in their study of technology in the home. This is a time for an in-depth look at the technology in the home as a modern day phenomenon. Questions to be examined in this stage of the program might include:

- Social impact on the family
- Environmental impact
- Alternatives to the present technologies
- Scientific principles involved
- Contrasting the present with the past
- Projecting the nature of technology in the home for the future

Summation

The tenth and final phase deals with the issue: "What have we learned?" This would deal with the following factors:

- Value of technology in the home
- Various impacts of technology in the home
- Technical information gained
- Attitude changes
- Consumer information
- Historical appreciations
- Science and other disciplines involved

Figure 2 is a schematic of the instructional strategy presented in this section.

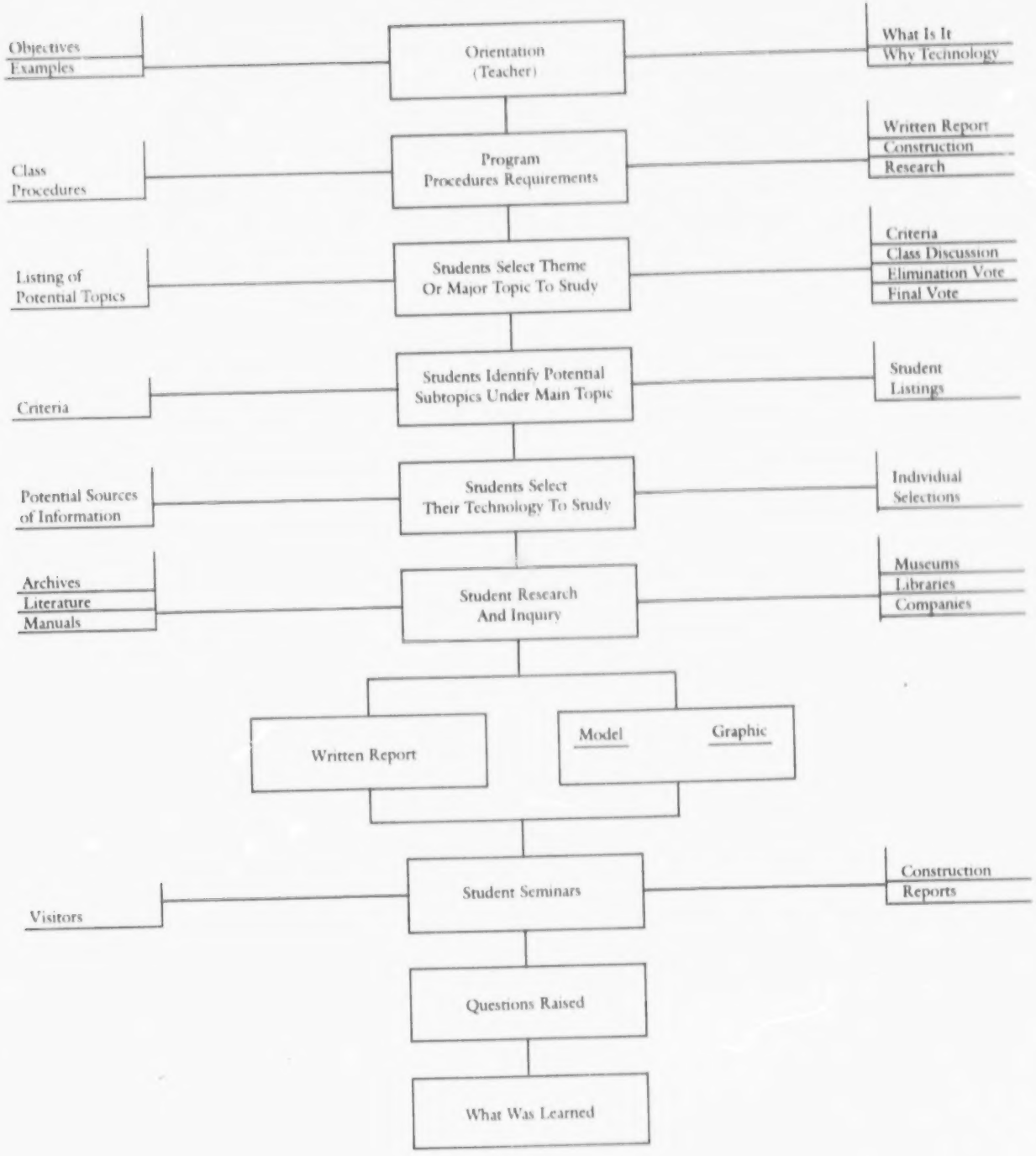
Student Productivity

The student productivity in the Technology in Our Homes program is largely dependent on the nature of the laboratory or classroom in which the students work. It also is related to the grade level of the student.

The productivity (of a physical nature) involves two different forms. The first is a report on a particular technology found in the house. The elementary grade report would contain the elements as presented earlier. This report would be prepared by the student for presentation to the class. It may be supplemented with objects, models, graphics and other items to assist in the communication process.

The second, or construction dimension of the program, is less definite due to the level of learner and the availability of facilities for construction in the early grades. Some potential construction activities could involve the following:

- Development of graphics of an object or system
- Constructing a model of a system
- Constructing electrical circuits using batteries and low voltage system
- Using model electric train sets to illustrate technological innovations in controls, power, communications, circuitry, automatic functions and so on
- Constructing communication devices, e.g., door bell, buzzer and lights
- Constructing solar heating devices
- Constructing models or graphics of technological innovations in the homes of the early settlers in America
- Making timeline charts showing the technological evolution of the home
- Developing lists of current technological innovations in the home
- Projecting (listing) future technological innovations in the home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Or Major Topic To Study
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Elimination Vote
Final Vote
Criteria
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Student Research
And Inquiry
Museums
Libraries
Companies
Written Report
Model
Graphic
Visitors
Student Seminars
Construction
Reports
Questions Raised
What Was Learned

Student Development

Student development in this context deals with the personal-human growth factor that comes as a result of experiencing the Technology in Our Homes program. Such development might include:

- A level of familiarity with common technological items or systems.
- An appreciation of the role technology plays in the home.
- Hand and eye coordination in working with things and making drawings.
- A positive attitude towards technology.
- A curiosity regarding how things work.
- An awareness of how the technology in the home has changed over the years.
- An increasing interest in the study of technology in and beyond the home.
- An understanding of sources of information dealing with technologies.
- Improved communication (written and verbal).
- Improved understanding of the applications of mathematics and science.

Interdisciplinary Potential

An interdisciplinary potential exists at all levels of instruction related to the Technology in Our Homes program and might take the following forms:

- English and communication in the written reports.
- Calculating cost of technology such as electricity, heating, cooling, etc.
- Comparing costs of technology
- Identifying science concepts related to the selected technologies.
- Identifying mathematics concepts related to selected technologies.
- Analyzing how technology has changed home life.
- Verbal communications through making presentations to the class.
- Analyzing how the technology in the home varies in different geographical areas.
- Analyzing how the technology in the home has changed since the days of the early settlers in America.
- Examining how the work requirements in the home have changed over the years.

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Resources

The Technology in Our Homes program can use a broad range of resources from people to publications as well as technical manuals to advertisements or sales literature. Some sources of materials that students might use follow:

- Textbooks dealing with particular technologies such as refrigeration, air conditioning, solar heating and furnace systems.
- Sales literature dealing with technologies in the home.
- Sales persons, vendors, or merchants who deal with technologies in the house.
- Technicians or mechanics who maintain and install such technologies.
- Technical manuals associated with the maintenance, use, and repair of the technologies.
- Contractors whose business it is to install various technological systems in the home such as telephones, communication systems, sound systems, burglar alarms, electricity, heating, cooling, etc.
- Local building inspectors from government agencies.
- Teachers of technology systems from the local community colleges or vocational/technical schools.

Several of these involve community contacts not commonly used by the schools. Here is another opportunity for developing good relationships beyond the school.

The International Technology Education Association is the leading technology education association. ITEA's first and only priority is to serve the technology educator with materials and programs for classroom use and professional development.
For more information about ITEA's program or for membership information please write: ITEA, 1914 Association Drive, Reston, VA 22091-1502; 703/860-2100.

INTERNATIONAL TECHNOLOGY EDUCATION ASSOCIATION
1914 ASSOCIATION DRIVE, RESTON, VA 22091-1502

A Study of the Technological Evolution of a City

A Part of the
SCIENCE/TECHNOLOGY/SOCIETY
RESOURCE PACKAGE

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International Technology Education Association
Reston, VA

Preface

This publication is one of a number of efforts by the International Technology Education Association to help broaden individual teacher's perspective on the range of potential content and programs for Technology Education, as well as Science, Technology and Society (STS). This material provides basic instruction and information that would be useful in the conduct of inter-disciplinary studies involving Technology Education classes along with such areas as economics, social studies, history, mathematics and science. These materials may also be used by the Technology Education teachers in their development and conduct of programs that are new and innovative.

It is important to note that the conduct of such programs centers around a number of popular issues in contemporary education. Emphasis is placed on experiential and first-hand learning in practically all areas of the programs. Problem solving and inquiry are essential along with the integration of mathematics, science, social studies and environmental studies.

Another important element of such programs is that the laboratories as found in most schools at the middle, junior and senior higher levels can be used for the construction/experiential aspects without any significant change. This is not to say that modern technology and computers would not be useful. The issue is that one should not put a major laboratory rennovation as an obstacle to the carrying out of what can be a true and exciting study of technology.

Acknowledgements

Thanks to the following professionals for supplying the photographs used in this series:

- *Kenneth Baker, Smithsburg High School, Smithsburg, MD*
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Figure 1 was developed by Kenneth S. Volk, a student in the Department of Industrial, Technological and Occupational Education at the University of Maryland, College Park.

Introduction

The Technological Evolution of a City program (which can focus on any other jurisdictional unit as well) has two important dimensions. First, it is a study of a city or jurisdiction that is of interest or even "home" to the students. Second, it is an excellent instructional procedure by which the students may examine the historical development of a governmental unit and at the same time develop an understanding of the role technology has played in its growth.

The study also provides a whole new arena of resources of a local nature that are seldom used in the school programs. The use of these community or local resources provides a new entree into school-community relations as well as understanding.

Such a study may also provide insights into the role that technology has and continues to play in the development of a city or other unit. It also provides the means for gaining understanding related to the impact of technology.

As a final note, the teacher should not overlook the potential this program offers for interdisciplinary study involving economics, history, transportation, employment, sociology, ecology and geography.

Don Maley

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A Study of the Technological Evolution of a City

The Technological Evolution of a City program is a historical approach to seeing how any city, county or state has developed with respect to technology. The technological evolution study may take into account such areas as transportation, communications, energy, manufacture, water development, sewage and waste control, housing and health. The evolving technology is plotted on a time line from the earliest known development to the present. Figure 1 shows such a timeline for Washington, D.C.

This is a whole class activity. Once the timeline of technological developments has been achieved, the individual student activities are started. Each student (or, in some cases, pair of students) selects a particular development as their contribution to the total class study of the technological evolution of their selected city, county or state.

One or two students may select the airport, another one or two the harbor, another the first automobile, another the streetcar, another a bridge, etc. These individual selections are carried out with constructions and written reports. The culminating activity consists of a series of seminars dealing with the various technological advents and a display.

A particularly appealing dimension of this program is that the central theme of the study deals with the home city, county or state. It also takes advantage of local sources of information, including people, archives, libraries, public documents, historical markers, and early newspapers or other records.

Unique Features

A unique aspect of this program is the localized nature of the study, the sources of information, and the opportunities for interdisciplinary integration of subject matter. Some of the specifics of this uniqueness include the following:

- The subject of the technological study is related to the local area (town, city, county or state) in which the class is located.
- Many of the elements of the technological evolution are available to see and use at the time of the study.
- The sources are local and diversified—from individuals to libraries and from archives to museums, collections or other repositories.
- The students, parents, and grandparents may be able to identify with the elements in the evolution of the governmental unit.
- The technological evolution of a city, etc., is uniquely suited to an interdisciplinary study of geography, civics, history, sociology and economics.
- The actual class instructional strategies involve processes that have proven successful in other programs, i.e., group projects, individual projects, unit approach, and seminars.
- Such a study provides a unique opportunity for the student to develop a greater understanding and appreciation of their local community or governmental unit studied.

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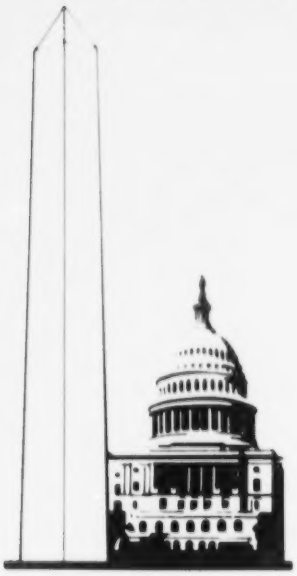
TECHNOLOGY TIMELINE OF WASHINGTON D.C.



1976 Metro Subway Opens

Street Car Service Ends 1962 — 1964 Capital Beltway

Television Station 1940 — 1940 National Airport Opens

1931 First Public Demonstration of Television

Traffic Signals Installed 1926 — 1924 Cheseapeake and Ohio Canal Closed

1923 WCAP and WRC Radio

First Airplane Landing Field in D.C. 1917

Transcontinental Telephone D.C. to San Francisco 1913 — 1907 Union Railroad Station

Sewage Disposal Plant 1904 — 1903 First Licensed Automobile Driver

1900

Willard Hall First Motion Picture Shown in D.C. 1899 — 1897 First Automobile in D.C.

Eckington & Soldiers Home Electric Railway 1886 — 1890 Hollerith's Electric Tabulating Machine

1883 Commercial Electric Power

1878 Telephone Service Begins

Washington Canal Covered 1870 — 1871 White House Stables Removed

1861 Balloons Used for Military Observations

Washington Aqueduct, Uses a Water Pressure Engine Pump 1860 — 1857 First Daily Weather News: The Evening Star

First Complete Indoor Plumbing 1850

Morse's First Telegraph Office 1844 — 1848 Gas Lights Installed in White House

1835 Rail Transportation: Washington-Baltimore

Cheseapeake and Ohio Canal, Water Power Used to Power Mills 1830 — 1830 Horse Drawn Omnibusses

Paper Mill on P Street 1828 — 1820 First Running Water: Van Ness House

Washington Canal 1810 — 1809 Fulton Develops Models for Steamship

First National Newspaper: The National Intelligencer 1801

1800

1797 Chain Bridge Over the Potomac

1756 Young's Grist Mill

1750 Shipyards, Sail Lofts, Warehouses Constructed

Holmead Mill 1740

1720 Anacostan Ferry

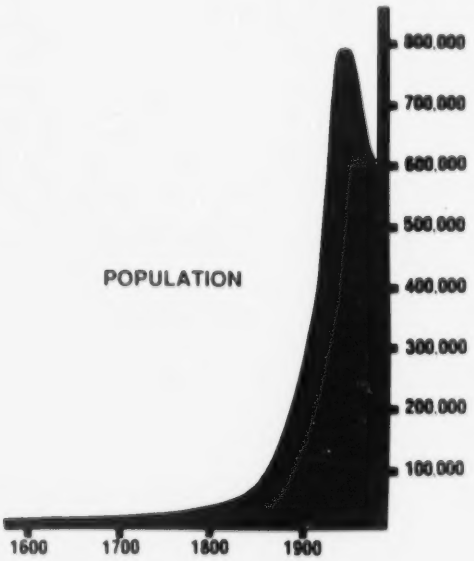
1700

1608 Captain John Smith Explores and Draws First Map of the Area

1000 B.C. Stone Quarry Near Rock Creek

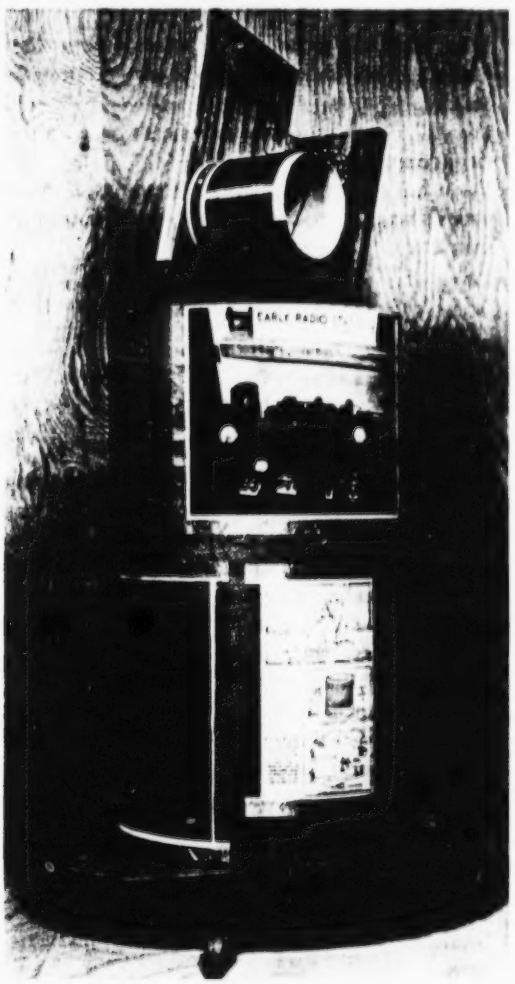
Nacostin and Anacostine Indians

Clay Pots, Bowls Carved from Stone and Wood



Grade Levels

The Technological Evolution of a City program may be conducted at several educational levels ranging from elementary to senior high school. At the elementary school it could be integrated into other studies such as geography, history and social studies. The middle or secondary levels would find the technological evolution of the governmental unit as the central core with the other disciplines of social studies, geography, science, history, and environmental studies being integrated into the technological study. The range and detail of constructional activities, research and reports would vary with the maturity of the student involved.



Goals

The program has these goals for students:

- Develop and demonstrate a sensitivity of the role that technology has played in the evolution of the individual's city, county or state.
- Develop skills in locating and using resource materials required to pursue such a study.
- Identify some of the advantages or problems accruing from the particular individual technological project selected for study.
- Conduct research, plan and construct a model or appropriate graphic of the particular item he/she has selected for contribution to the total study.
- Conduct research and write a report dealing with the particular technological evolution item he/she has selected.
- Report to the class on the nature and contributions of the technology selected by him/her towards the development of the city, county or state.
- Discuss the following interdisciplinary dimensions of the particular technology he or she has selected: mathematics concepts, science principles, social impact, environmental impact and economic impact.

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Instructional Strategies

The program involves several basic strategies such as: the individual project, the group project, the unit method of organization, and the seminar. The actual conduct is carried out in four phases.

Phase 1—Class Orientation

The teacher describes the nature of the study to be carried out by the students:

- The technological evolution of a city, county or state is described.
- Examples of such a study are presented (see accompanying resource materials)
- The kinds of student activities include researching, planning and instructing, writing a report, making decisions, presenting a report, sharing and discussing, and conducting seminars.
- The goals to be achieved in the activity. (See previously listed goals to be achieved.)

The students, with the guidance of the teacher, identify a number of potential sources of information for developing the timeline for their city (county or state). Possible sources include:

- Libraries
- City Hall records
- Local people in authority
- Public documents
- Newspapers
- Historical markers
- Dedication markers
- Museums
- Fairs

Phase 2—Developing a Timeline

First, a city, county or state is selected for study. Then the areas for technological study are identified, such as transportation, communication, energy, etc. A tentative listing of possible technological developments under each of the several areas is made on the chalkboard. The areas identified will, of course, depend on the particular city, county or state selected.

Example: (in the area of transportation)

- Indian dray
- Horse drawn vehicle
- Automobile
- Airport
- Streetcar

Similar lists are made for the other technological areas of communication, energy, manufacture, water development, sewage and waste disposal, housing and health. (These lists are made with strong student participation.)

Students work in teams to research and identify the times when certain technological innovations were introduced into their city (or state or county).

- Team A—Transportation
- Team B—Communications
- Team C—Energy
- Team D—Manufacture and agriculture
- Team E—Water development
- Team F—Sewage and waste disposal
- Team G—Housing and construction
- Team H—Health

When the teams have completed their research, a timeline for the city (county or state) is developed compiling the findings of the team efforts.

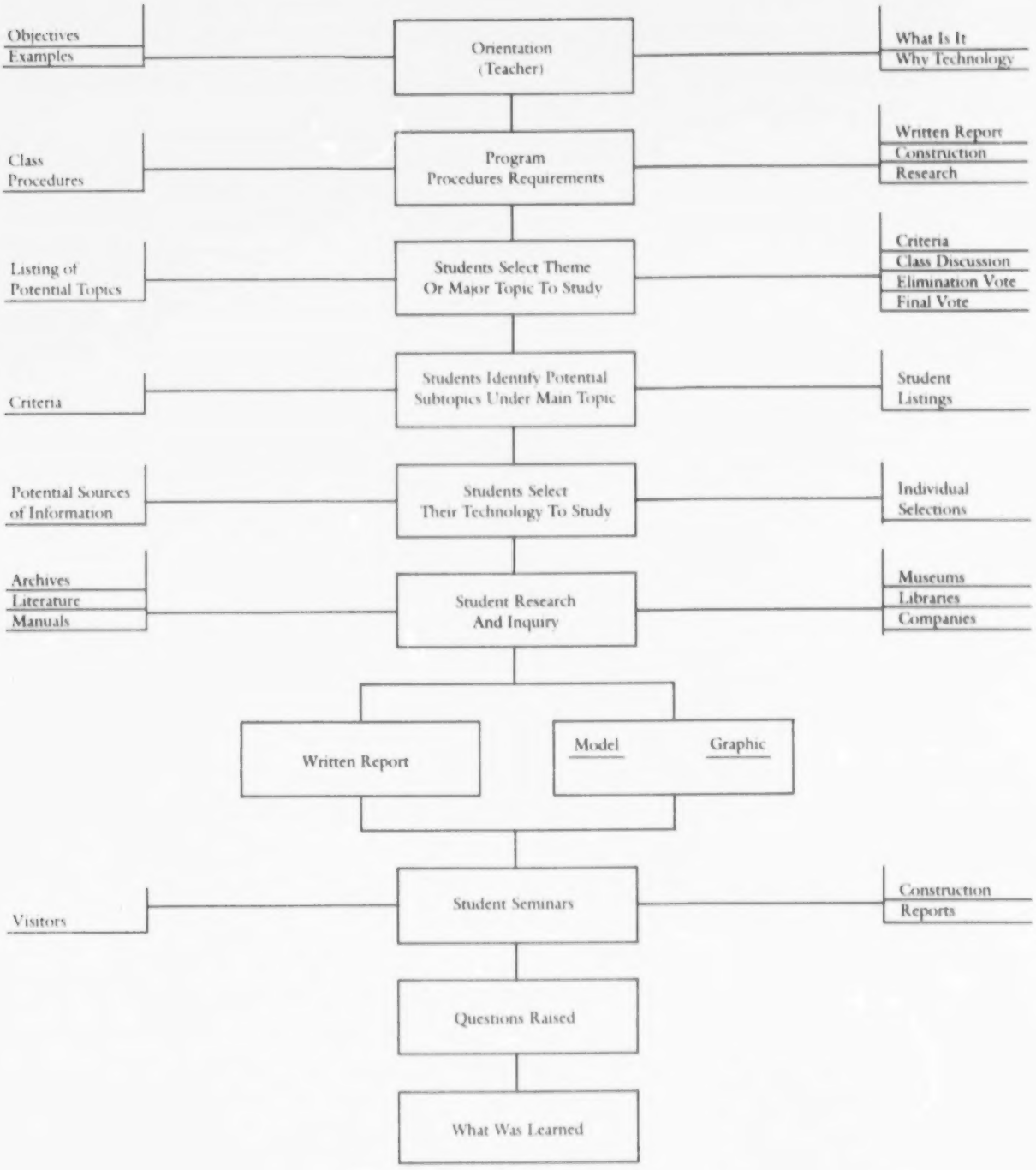
Upon completion of the timeline, a class discussion is conducted on the following issues or concerns.

- What was life like in the city (county or state) at various points in time?
- What were the major kinds of employment at the different times?
- What were the technological developments that made a major difference in the city (county or state)?
- Were all technological developments good for the city (county or state)?
- What has been the result of technological innovations being introduced into the city (county or state)?

Phase 3—Detailed Study of Selected Technological Developments

This phase builds on the work done developing the timeline in Phase 2. The goal is to have the students make a detailed study of a number of the items on the timeline chart depicting the technological evolution of the city, county or state. The detailed study involves the making of a model or graphic representation of the technological innovation plus a written report.

- Students—either on an individual basis or in pairs (for larger items)—select an item from the timeline to study in detail.
- Students do a background study of their selected technological innovation.
- Students—individually or in pairs—plan and construct a model of their particular technological innovation.
- Students develop a display for their constructed item.
- Students write a report on their particular technological selection relative to the technological evolution of the city.


Objectives
Examples
Orientation
(Teacher)
What Is It
Why Technology
Written Report
Construction
Research
Class
Procedures
Program
Procedures Requirements
Criteria
Class Discussion
Elimination Vote
Final Vote
Listing of
Potential Topics
Students Select Theme
Or Major Topic To Study
Criteria
Students Identify Potential
Subtopics Under Main Topic
Student
Listings
Potential Sources
of Information
Students Select
Their Technology To Study
Individual
Selections
Archives
Literature
Manuals
Student Research
And Inquiry
Museums
Libraries
Companies
Written Report
Model
Graphic
Visitors
Student Seminars
Construction
Reports
Questions Raised
What Was Learned

The student report should contain the following elements:

- Title
- Purpose for selecting the item
- Description of the technological innovation along with its date
- Contributions to the city (county or state) made by the item
- Problems or ill effects of the item
- Mathematics or science principles involved in the technological developments
- Social impact of the innovation
- Environmental impact of the innovation
- Economic impact of the innovation
- Conclusions drawn about the technological innovation's impact on the city
- Sources of information from which the report was written

Phase 4—Seminars

During the seminar phase of the program students get an opportunity to share their construction and report to the other members of the class. It is also an opportunity for the students to make an analytical examination of what has happened (technologically speaking) to their city (county or state) and to discuss the impact of such innovations. The seminars:

- Provide a system of communication and cross-fusion of ideas and information.
- Provide a forum for students to present their work and report to the total class.
- Provide a mechanism for students to help each other identify problems and clarify information.
- Develop leadership and communication skills.
- Develop a feeling of self-worth among the students.

The seminar format or agenda varies in accordance with the progress of the students with their construction and their report. The early seminars are Progress Seminars intended to provide assistance to the students as well as assist the teacher in assessing the progress being made by each student. The agenda would include the following items:

- Introduction by Chairman
- Individual Progress Reports
- Statement of Titles and Problems
- Analysis and Discussion
- Items of Interest
- Closing Comments

The emphasis in these early seminars is on progress being made by the student, as well as any problems encountered. The other students in the class are encouraged to assist in problem solution for individuals having such.

The second level of seminars is called the Comprehensive Seminar. Limited and generally incomplete reports are made by one or two students at these seminars. The agenda for the comprehensive seminar is:

- Introduction by Chairman
- Individual Progress Reports
- Comprehensive Reports—Analysis and Discussion
- Presentation of Individual Problems
- Items of Interest
- Closing Comments

The last, or third, level of seminars is called the Final Seminar. These seminars are conducted as soon as students begin to complete their projects and reports. One or two students make final presentations at these seminars. The agenda for this level of seminar is:

- Introduction by Chairman
- Final Presentations—Analysis and Discussion
- Items of Interest
- Closing Comments

The "items of interest" in each of the levels of seminars is an opportunity for the student to discuss technological items or news related to technology that are in the newspapers, magazines, or other media. It is a very important element of the seminars.

Figure 2 illustrates an instructional procedure that may be used in the conduct of a study of the technological evolution of a city.

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Group Project Format

The group project represents another form of instructional procedure for the study of the technological evolution of a city (or other jurisdictional unit). The initial activity in this strategy is again the development of a timeline chart (Figure 1). This would be a total class activity with the research and development of the chart carried out by the students.

Group projects may take the form of large, three-dimensional dioramas depicting the nature and development of the city at a selected time in the evolution of the town. The class may select any period in the history of the city. As an example the diorama may present the technological status of the city as it appears in 1800, 1900, or 1988.

Another modification of the group project approach to the technological evolution of a city would be to have a diorama constructed showing the natural physical features (boundaries, rivers, bays, hills, terrain) of the area. This would serve as the base model onto which the technological innovations of any period in the evolution of the city could be located with individual models of the particular technologies of the time.

Such group project activities would first involve the establishment of the project management personnel organization. This would follow personnel organization models characteristic of large project industries. This would include such positions as—project director, educational director, construction director, personnel director, safety director, design director, etc.

The initial base diorama would be a total class effort under the direction and leadership of the project director and the appropriate management personnel. The particular technological innovations to be mounted or depicted on the base diorama of the city would be selected according to the period of time in the history of the city that the class would select.

The assignment of particular technological innovations to be constructed or depicted by individual students would be on the basis of students volunteering or by assignment by the project director or personnel director.

Each individual assigned a technological innovation to be represented on the base diorama would construct the model or its representation and also write a report on the items. This report would contain:

- Name of the technological innovation
- Date it was introduced into the city
- Description of the innovation
- Significant contribution the innovation made to the city
- Social and environmental impact of the item
- Period of time it remained effective in use in the city
- Economic or other impact on the city

Presentations of all such reports would be made at total class conference sessions presided over by the project director or the educational director.

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Student Productivity

The technological evolution of the city is characterized by a broad range of student activity as well as productivity. It is a program that can effectively integrate local history into Technology Education in a meaningful way. There are several areas of productivity that may be attributed to such a study.

The students produce a timeline of the technological evolution of their city, county or state. This could be a large poster or graphic display. Specific student activities related to this timeline productivity include:

- Decision-making
- Researching
- Reporting
- Sharing
- Thinking
- Developing a graphic
- Interpreting the timeline

The second element of productivity is the construction of a physical model or an appropriate graphic depicting one of the technological innovations in the evolution of the selected city, county or state. Specific student activities associated with this construction include:

- Decision making
- Researching
- Planning
- Constructing
- Measuring
- Calculating
- Sharing
- Interpreting
- Analyzing
- Inquiring

The third component of student productivity deals with the written report and its presentation. Specific student activities associated with this report include:

- Inquiring
- Researching
- Planning
- Writing
- Thinking
- Organizing
- Interpreting

The fourth area of productivity is in the conduct and performance related to the seminars. Student activities associated with their participation in the seminars include:

- Leading
- Speaking
- Planning
- Sharing
- Interpersonal relating
- Thinking
- Challenging

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Student Development

The Technological Evolution of a City program has many potentials for student development. It is a program in Technology Education that focuses on many of the human attributes essential for effective living in a technological society. These include:

- Developing resourcefulness
- Making assessments of technology
- Developing attitudes towards technology
- Developing communication skills
- Developing manual-mental skills
- Developing organizing skills
- Developing a willingness to share
- Developing problem-solving abilities
- Developing analyzing abilities
- Developing a positive self-image

Interdisciplinary Potential

The Technological Evolution of a City program is an ideal component for the implementation of an interdisciplinary approach. First, it is a historical study dealing with a unit (city, county or state) directly related to the individual or students living in that community. The identification of technological events or innovations in the life of a city (or other unit) brings with it a variety of linkages with economics, social impact, environmental impact, population growth, business and industrial implications.

The technological evolution of a community is, in many respects, the "cause" or "effect" of what happens in that area. Changes in technology, economics, population and sociology all have their impacts on the city as well as the other disciplines associated with it. The city, in this respect, is organismic in nature and not an isolated series of individual parts. As an example, the advent of the automobile in a city would have impact or influence on the nature of streets, roads or highways, business developments, services required, maintenance facilities, structures including garages, employment opportunities, traffic and safety control, as well as many more.

The same impact analyses may be made for practically every significant innovation into a city or removed from a city. This process by which such cross disciplinary involvement or potential may be realized may take on many forms.

Key questions may be raised by or with the class, i.e. What impact has the innovation (the advent of the automobile) had on the economics of the city? What has been the impact of the innovation (automobile) on the location of population in or out of the city? What has been the environmental impact of the automobile on the city?

Other interdisciplinary potentials include:

- The history instructor in the school may be called to discuss the historical factors associated with the technological evolution of the city.
- The students may be asked to identify a series of questions the technological evolution of a city may raise.
- The students may be asked to write reports or essays dealing with the impact of certain technologies on specific disciplines, e.g., economics, population, business, etc.
- Students may be asked to make assessments of the value and implications of selected technological innovations in the evolution of the city.

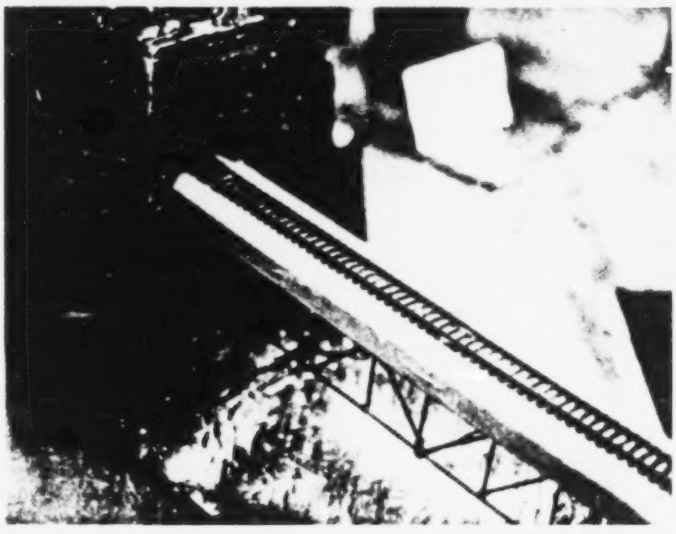
Resources

The Technological Evolution of a City program draws on some unique sources for its information and data. The information for the most part is generally available from local (city, country or state) sources. This local availability of information also provides for some unusual places for the students to visit in their research. These local resources include:

- Local archives
- Historic markers
- Historical associations
- Libraries
- Older citizens
- Local historians
- Museums
- Local fairs
- City Hall records
- Dedication markers
- Newspaper
- Minutes of meetings

The research and inquiry potential in such a study is considerable. It also provides for a better understanding of the community in which one lives. Such a study also deals with a real community of which the students are a part.

ITEA has a number of background resource materials available that contain other useful items. A complete listing of available materials is listed in the ITEA Catalog.



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Further Information?

Publications and videos covering other aspects of Technology Education—resources, curriculum materials, contemporary programs, etc.—are available from the International Technology Education Association.

Additional materials from ITEA are available to help in the areas of:

- Project activities and development
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